# EXECUTIVE SUMMARY

## ENERGY SAVINGS OPPORTUNITY SURVEY FOR DESIGNATED FACILITIES AT VARIOUS U.S. ARMY INSTALLATIONS OAHU, HAWAII

PREPARED FOR:

Department of the Army
Pacific Ocean Division
Corps of Engineers





PREPARED BY:

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AUGUST 1987

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August 31, 1987

Commander
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Gentlemen:

SUBJECT: Energy Savings Opportunity Survey for
Designated Facilities at Various
U.S. Army Installations, Oahu, Hawaii
Contract No. DACA83-86-D-0101, D.O. 0001

We are pleased to submit eighteen (18) copies of the Executive Summary and Final Report for the subject project. The distribution of these copies has been made to the parties as specified in Annex B of the Scope of Work.

Should you have any questions related to this submittal, please call us at (808) 524-8200.

Very truly yours,

Yong-Jin Rim, P.E.
Vice President

YJK:G-1
Encl: Executive Summary and
Final Report (18)

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5. Army Regulations:

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   g. AR5-4 Change No. 1 Department of the Army Productivity Improvement Program

6. Engineer Improvement Recommendation System (EIRS) Bulletin 84-01, dated 29 June 1984 and Tri-Service Military Construction Program (MCP) Index for FY87 Program dated 4 January 1985.

7. OCE Letter DAEN-ZCF-U, Energy Conservation Investment Program (ECIP) Guidance, dated 11 June 1986.

8. Specified Facility Energy Studies for Energy Engineering Analysis Program (EEAP) at U.S. Army Support Command, Hawaii (USASCH) Installations, June 1987, by W.A. Hirai & Associates, Inc.

## LIST OF ABBREVIATIONS

| | |
|---|---|
| A/C | Air Conditioning |
| ASHRAE | American Society of Heating Refrigeration and Air Conditioning |
| COE | Corps of Engineers |
| DHW | Domestic Hot Water |
| DOD | Department of Defense |
| ECIP | Energy Conservation Investment Program |
| ECO | Energy Conservation Opportunity |
| EEAP | Energy Engineering Analysis Program |
| ESOS | Energy Savings Opportunity Survey |
| EWH | Electric Water Heater |
| FY | Fiscal Year, October 1 Thru September 30 |
| HVAC | Heating, Ventilating and Air Conditioning |
| KW | Kilowatt |
| KWH | Kilowatt-Hour |
| LCCA | Life Cycle Cost Analysis |
| LPG | Liquified Petroleum Gas |
| MBTU | Million British Thermal Unit |
| OH&P | Overhead and Profit |
| POD | Pacific Ocean Division |
| SIR | Savings-Investment Ratio |
| SNG | Synthetic Natural Gas |
| SOW | Scope of Work |
| SPP | Simple Payback Period |
| TM | Technical Manual |
| UPW | Uniform Present Worth |
| USASCH | U.S. Army Support Command, Hawaii |

# EXECUTIVE SUMMARY

## 1. OBJECTIVE

This Energy Savings Opportunity Survey (ESOS) is to identify Energy Conservation Opportunities (ECO's) which are practical and economical for the reduction of energy consumption in accordance with the Army Facilities Energy Plan. This survey involves only designated facilities at various U.S. Army Installations.

## 2. SCOPE OF WORK

The work to be performed under this project includes the following tasks:

a. Coordinate with the on-going and proposed energy projects.

b. Conduct a limited site survey to identify applicable ECO's and obtain necessary data to evaluate the ECO's.

c. Evaluate applicable ECO's to determine the feasibility in accordance with current ECIP guidance.

d. Prepare complete programming and implementation documentation for the implementation of recommended projects.

e. Prepare a comprehensive report to document the work performed including energy analyses, the results and recommendations.

The facilities covered under this survey are listed on Table 1.

## 3. ENERGY CONSERVATION OPPORTUNITIES

During the field investigation, each designated facility was carefully examined to identify the applicable ECO's which are to be evaluated for their implementation. The text of ECO's was taken from the listed ECO's in Annex A of the Contract Scope of Work. Some of those ECO's are not applicable to the facilities covered under this study. The following are INAPPLICABLE ECO's and their reasons:

a. Insulation: Temperature gradients between ambient air and conditioned air are too small to make any U-factor improvement practical. Previous study revealed that Savings-Investment Ratio (SIR) for this ECO was 0.31 or less.

b. Storm Windows or Double Grazing: Same as item a.

c. Insulated Panels: Same as item a.

d. Vestibules: Previous study revealed that SIR for this ECO was 0.40 or less.

e. Load Dock Seals: No loading dock is involved in this study.

f. Reduction of Glass Area: Previous study revealed that SIR for this ECO was 0.31 or less.

g. Replace Kitchen Light Fixtures: Energy efficient fluorescent fixtures are already installed.

h. Shutdown Energy to Hot Water Heaters or Modify Controls: This ECO is inapplicable to the facilities except lowering H.W. temperature controls which is recommended as a maintenance item.

i. Improve Power Factor: Base-wide power factor improvement already has been implemented.

j. High Efficiency Motor Replacement: This ECO is not feasible for small horsepower motors in the designated facilities.

k. Night Setback/Setup Thermostats: This ECO is inapplicable for the facilities as no heating is required and air conditioning is to be cut off in lieu of temperature setup.

l. Infrared Heaters: No heating is required.

m. Economizer Cycle: Due to the tropical climate, utilization of outside air for space cooling is not feasible because of high temperature and humidity of outside air during the operational period.

n. Control Hot Water Circulating Pump: No heating is required.

o. FM Radio Controls: Radio control of building energy system is not practical for small building energy systems involved in this study.

p. Decentralize Domestic Hot Water Heaters: Domestic hot water systems are already decentralized.

q. Reduce Air Flow: All A/C systems are small constant air volume systems and no energy savings are expected by reducing air flow.

r. Prevent Air Stratification: This ECO is inapplicable to cooling.

s. Boiler Oxygen Trim Control: No boiler is involved in this study.

t. Revise Boiler Controls: No boiler is involved in this study.

u. Chiller Replacement: Existing chiller is operating satisfactorily and no replacement is warranted.

v. Replace Absorption Chiller: No absorption chiller is involved in this study.

w. Insulate Steam Lines: No steam system is involved in this study.

x. Return Condensate: No condensate system is involved in this study.

y. Domestic Hot Water Heat Pumps: Most of the domestic hot water heaters use SNG gas which is already at a low cost and heat pumps offer no significant advantage. The facilities where electric water heaters are provided have very low hot water demands (offices) and do not offer enough savings for the ECO.

z. Transformer Overvoltage and Loading: By clarification of the scope of work, these ECO's are not included.

aa. Occupancy Sensors to Control HVAC: The ECO is applicable only to single private rooms with its own A/C system. The A/C systems for the facilities in this study include multiple rooms of various functions, therefore, this ECO is not applicable. The timeclock control is more suitable for the control of A/C systems in this study.

ab. Occupancy Sensors to Control Lighting: The use of occupancy sensors to control lights for facilities involved in this study is not feasible for the following reasons:

(1) Many of the facilities involved practice energy conservation by turning off lights for rooms not in use.

(2) For smaller rooms, replacement of wall toggle switch with a motion sensor switch cannot be justified unless the occupant frequently forgets to turn off the light several nights per week.

(3) Many large rooms have interior partitions that would require several motion sensors and relays resulting in substantially higher initial cost.

(4) Location of switches must be carefully selected to avoid direct light sources (for infrared type), minimize dead spots which may cause lights to turn off when occupants are present, etc.

Some applicable ECO's which can be implemented by installation maintenance personnel using regular maintenance and repair funds are classified as maintenance items. The following is the list of ECO's recommended as MAINTENANCE ITEMS:

a. Weatherstripping on doors and windows.
b. Reflective film on windows.
c. Close doors which are open between conditioned area and non-conditioned area.
d. Resetting thermostats at proper temperature.
e. Install insulating blankets on electric water heaters.
f. Install flow restricting devices on showers.
g. Repair of damaged insulation on equipment and piping.
h. Clean or replace clogged air filters.
i. Repair smashed coil fins.
j. Delamp fluorescent fixtures where lighting level is excessive.
k. Turn off unnecessary lighting and exhaust fans.
l. Clean lighting fixture lenses and lamps.

After careful evaluation, the following ECO's are selected as Applicable ECO's:

a. Architectural ECO's
   A-1 Storm Windows for Jalousie Windows
   A-2 Drop Ceilings
   A-3 Insulated Overhead Door

b. Mechanical ECO's

M-1 Timeclock Control for A/C Systems

M-2 A/C Heat Recovery Systems

M-3 Make-Up Air for Exhaust Hoods

c. Electrical ECO's

E-1 Replace Incandescent Fixtures With Fluorescent Fixtures

E-2 Replace Incandescent Fixtures With HPS Fixtures (Interior)

E-3 Replace Incandescent Fixtures With HPS Fixtures (Exterior)

E-4 Time Switch Control for Exterior Lighting

E-5 Photo Switch Control for Exterior Lighting

Table 2 shows the matrix of applicable ECO's and the building numbers for which the ECO is applicable.

## 4. ENERGY AND LIFE CYCLE COST ANALYSIS

All applicable ECO's for the designated facilities were evaluated for their economic feasibility for implementation in accordance with the latest criteria. The evaluation process includes energy and other savings analysis, project cost estimate and life cycle cost (LCC) analysis to determine the cost effectiveness. Cost effective projects are those for which the Savings-Investment Ratio (SIR) is 1.0 or greater.

The evaluated ECO's are listed on Table 3 by their SIR rank. Table 3 also shows the estimated construction cost, annual energy savings in MBTU and dollars, SIR and Simple Payback Period (SPP) for individual ECO's.

## 5. PROJECT SUMMARY AND RECOMMENDATIONS

As shown on Table 3, the recommended projects for funding are twenty-seven (27) projects that represent a total construction cost of $126,460, annual energy savings of 1,022.62 MBTU, and total annual savings of $26,469. Their average SIR is 2.10 and SPP is 8.3 years. For these projects, the implementation documents (DA Form 4283) have been prepared. FY87 OMA Fund will be applied for the implementation of these projects.

Ten (10) ECO's failed to qualify as cost effective projects because their SIR's were lower than 1.0: four (4) architectural ECO's including storm windows and drop ceilings; five (5) electrical ECO's including time and photo switches for exterior lighting; and one (1) mechanical ECO, heat recovery system. The average SIR is 0.50 and SPP is 40.2 years.

As illustrated by the results of this study, energy conservation opportunities must be concentrated on the direct improvements of energy systems such as air conditioning and lighting systems.

The field survey also identified numerous maintenance items which can be implemented by installation maintenance personnel. They include items such as weatherstripping, cleaning filters of A/C units and resetting or recalibrating of thermostats. These maintenance items have been recommended previously as a part of the Field Investigation Report.

## 6. BUILDING ENERGY END-USE

The building energy end-use was analyzed for individual designated facilities to estimate the present annual energy consumption. This annual energy consumption rate becomes a baseline for calculating the energy savings attributed to applicable ECO's. Each building's energy end-use is broken down into the categories of air conditioning, lighting, domestic hot water and other equipment. Table 4 shows the results of building energy end-use analysis including present energy consumption, energy savings by recommended projects and projected energy consumption after implementation of recommended projects for each facility and category. Figure 1 shows the same results in graphic form.

The summary of energy end-use is as follows:

| Present Energy Consumption: | MBTU/YR | $/YR |
|---|---|---|
| Electricity | 16,479.20 | $362,048 |
| SNG | 770.05 | 7,562 |
| LPG | 36.06 | 349 |
| Total | 17,285.31 | $369,959 |

| Savings by ECO's: | MBTU/YR | $/YR |
|---|---|---|
| Electricity | 926.37 | $ 20,352 |
| SNG | 70.70 | 694 |
| LPG | 0 | 0 |
| Total | 997.07 | $ 21,046 |

Projected Energy Consumption:

| | | |
|---|---|---|
| Electricity | 15,552.83 | $341,696 |
| SNG | 699.35 | 6,868 |
| LPG | 36.06 | 349 |
| Total | 16,288.24 | $348,913 |

TABLE 1 (Sht 1 of 2)

LIST OF BUILDINGS INCLUDED IN THIS SURVEY

| BLDG. NO. | DESCRIPTION | CATEGORY CODE(S) | AREA (SF) |
|---|---|---|---|
| FORT SHAFTER: | | | |
| P-405 | Maintenance Shop & Administration Facility | 21885<br>61050 | (20,461)<br>( 8,745)<br>29,206 |
| SCHOFIELD BARRACKS: | | | |
| P-844 | Enlisted Men's Dining Facility | 72210 | 22,291 |
| P-672 | Enlisted Barracks w/o Dining | 72111 | 14,100 |
| P-673 | Laboratory | 53020 | 14,136 |
| P-676 | Hospital Clinic | 51020 | 9,840 |
| P-677 | Hospital Clinic | 51020 | 14,400 |
| P-678 | Enlisted Barracks w/o Dining | 72111 | 14,400 |
| P-679 | Admin. Gen. Purpose | 61050 | 6,531 |
| P-680 | Enlisted Barracks w/o Dining | 72111 | 14,876 |
| P-681 | Hospital Clinic | 51020 | 11,270 |
| P-682 | Hospital Clinic | 51020 | 13,800 |
| P-683 | Medical Admin. | 61025 | 6,580 |
| P-684 | Dental Clinic | 54010 | 14,490 |
| P-685 | Hospital Clinic | 51020 | 13,500 |
| P-686 | Hospital Clinic | 51020 | 14,700 |
| P-687 | Enlisted Barracks w/o Dining | 72111 | 14,700 |
| P-688 | Enlisted Barracks w/o Dining | 72111 | 14,400 |

TABLE 1 (Sht 2 of 2)

LIST OF BUILDINGS INCLUDED IN THIS SURVEY

| BLDG. NO. | DESCRIPTION | CATEGORY CODE(S) | AREA (SF) |
|---|---|---|---|
| P-691 | Pharmacy and Medical Supplies | 55090 | 4,390 |
| P-360 | DMMC Class I & III | 61023 | 12,274 |
| P-584 | Bowling Center | 74011 | 9,331 |
| P-580 | Division Headquarters Bldg. | 61012 | 88,786 |
| | | SUBTOTAL | 328,795 |
| FORT DERUSSY: | | | |
| 190 | Army Reserve Center | 17140 | 27,245 |
| 191 | Army Reserve Center | 17140 | 5,290 |
| 192 | Motor Repair Shop | 21410 | 6,092 |
| | | SUBTOTAL | 38,627 |
| WHEELER AIR FORCE BASE: | | | |
| 1003 | Flight Simulator Building | 17110 | 5,500 |
| | TOTAL: 25 Buildings | | 402,128 |

TABLE 2

| INSTALLATION & BLDG NO. | | APPLICABLE ECO'S | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A-1 | A-2 | A-3 | M-1 | M-2 | M-3 | E-1 | E-2 | E-3 | E-4 | E-5 |
| FS | P-405 | | | | X | | | X | | | | |
| SB | P-844 | | | | X | | X | X | | | X | |
| SB | P-672 | | | | | | | | | X | X | |
| SB | P-673 | | | | | | | | | X | | X |
| SB | P-676 | X | | | X | | | | | | | |
| SB | P-677 | | | | | | | | | X | X | |
| SB | P-678 | | | | | X | | | | X | X | |
| SB | P-679 | | | | | | | | | | | |
| SB | P-680 | | | | | | | | | | | |
| SB | P-681 | | | | | | | | | | | |
| SB | P-682 | | | | | | | | | | | |
| SB | P-683 | | | | | | | | | | | |
| SB | P-684 | X | | | X | | | | | | | |
| SB | P-685 | | | | | | | | | | | |
| SB | P-686 | | | | | | | | | | | |
| SB | P-687 | | | | | | | | | X | X | |
| SB | P-688 | | | | | | | | | X | | X |
| SB | P-691 | | | | | | | | | | | |
| SB | P-360 | X | X | | | | | X | | X | X | |
| SB | P-580 | | | | X | | | X | | | | |
| SB | P-584 | | | | | | | | | | | |
| FD | 190 | | | | X | X | | X | X | | | |
| FD | 191 | | | | X | | | X | | | | |
| FD | 192 | | | | | | | | | | | |
| WAF | 1003 | | | X | | | | | | | | |

A-1 STORM WINDOWS FOR JALOUSIE WINDOWS
A-2 DROP CEILINGS
A-3 INSULATED OVERHEAD DOOR
M-1 TIME CLOCK CONTROL FOR A/C SYSTEM
M-2 A/C HEAT RECOVERY SYSTEMS
M-3 MAKE-UP AIR FOR EXHAUST HOODS
E-1 REPLACE INCAND FXTR W/FLUORESCENT FXTR
E-2 REPLACE INCAND FXTR W/HPS FXTR (INTERIOR)
E-3 REPLACE INCAND FXTR W/HPS FXTR (EXTERIOR)
E-4 TIME SWITCH CONTROL FOR EXTERIOR LIGHTING
E-5 PHOTO SWITCH CONTROL FOR EXTERIOR LIGHTING

NOTE:

1. FS, SB, FD, AND WAF DENOTES: FORT SHAFTER, SCHOFIELD BARRACKS, FORT DeRUSSY, AND WHEELER AFB RESPECTIVELY.

TABLE 3

LIST OF PROJECTS RANKED BY SIR

| BLDG NO. | ECO NO. | PROJECT DESCRIPTION | CONSTRUCTION COST ($) | ENERGY SAVINGS (MBTU/YR) | TOTAL SAVINGS ($/YR) | SIR | SPP |
|---|---|---|---|---|---|---|---|
| RECOMMENDED PROJECTS | | | | | | | |
| P-844 | M-1 | TIME CLOCK, A/C | $8,074 | 346.96 | $7,623 | 9.26 | 1.1 |
| P-360 | E-1 | INCAND - FLUOR LT | $1,148 | 8.58 | $384 | 4.14 | 3.0 |
| P-844 | E-1 | INCAND - FLUOR LT | $7,356 | 38.37 | $2,199 | 3.66 | 3.4 |
| 191 | E-1 | INCAND - FLUOR LT | $5,735 | 38.03 | $1,688 | 3.65 | 3.4 |
| 190 | E-1 | INCAND - FLUOR LT | $5,464 | 34.88 | $1,560 | 3.54 | 3.5 |
| P-676 | M-1 | TIME CLOCK, A/C | $1,041 | 16.49 | $362 | 3.41 | 2.9 |
| P-580 | E-1 | INCAND - FLUOR LT | $8,988 | 38.70 | $2,218 | 3.02 | 4.1 |
| 190 | E-2 | INCAND - HPS, INT | $11,720 | 79.68 | $2,278 | 2.45 | 5.3 |
| P-405 | E-1 | INCAND - FLUOR LT | $1,293 | 3.46 | $248 | 2.29 | 5.3 |
| P-580 | M-1 | TIME CLOCK, A/C | $4,343 | 141.67 | $915 | 2.07 | 4.8 |
| P-688 | E-3 | INCAND - HPS, EXT | $6,800 | 18.86 | $823 | 1.48 | 8.4 |
| 190 | M-1 | TIME CLOCK, A/C | $8,386 | 56.00 | $1,244 | 1.45 | 6.9 |
| P-688 | E-5 | PHOTO SWITCH, EXT | $551 | 1.43 | $60 | 1.34 | 9.4 |
| P-678 | M-2 | A/C HEAT RECOVERY | $9,748 | 70.64 | $694 | 1.25 | 14.4 |
| P-678 | E-4 | TIME SW, EXT LT | $539 | 1.24 | $52 | 1.19 | 10.6 |
| P-672 | E-4 | TIME SW, EXT LT | $539 | 1.20 | $50 | 1.14 | 11.0 |
| P-405 | M-1 | TIME CLOCK, A/C | $2,270 | 12.06 | $265 | 1.14 | 8.8 |
| P-844 | M-3 | KITCHEN EXH HOOD | $4,380 | 22.62 | $497 | 1.11 | 9.0 |
| P-687 | E-3 | INCAND - HPS, EXT | $6,533 | 12.88 | $561 | 1.05 | 11.9 |
| P-672 | E-3 | INCAND - HPS, EXT | $8,000 | 15.81 | $690 | 1.05 | 11.8 |
| P-678 | E-3 | INCAND - HPS, EXT | $8,393 | 16.40 | $715 | 1.04 | 12.0 |
| P-684 | M-1 | TIME CLOCK, A/C | $1,041 | 4.97 | $109 | 1.03 | 9.7 |
| P-673 | E-3 | INCAND - HPS, EXT | $307 | 0.59 | $26 | 1.03 | 12.1 |
| P-677 | E-3 | INCAND - HPS, EXT | $4,259 | 8.20 | $358 | 1.02 | 12.2 |
| P-360 | E-3 | INCAND - HPS, EXT | $3,060 | 5.86 | $256 | 1.02 | 12.2 |
| 191 | M-1 | TIME CLOCK, A/C | $1,041 | 7.85 | $172 | 1.00 | 13.2 |
| 1003 | A-3 | OVERHEAD DOOR | $5,451 | 19.19 | $422 | 1.00 | 13.2 |
| | | TOTAL | $126,460 | 1022.62 | $26,469 | 2.10 | 8.3 |
| NON-RECOMMENDED ECO'S | | | | | | | |
| P-687 | E-4 | TIME SW, EXT LT | $511 | 0.97 | $42 | 0.99 | 12.4 |
| P-844 | E-4 | TIME SW, EXT LT | $510 | 1.42 | $33 | 0.84 | 15.8 |
| P-677 | E-4 | TIME SW, EXT LT | $511 | 0.62 | $27 | 0.64 | 19.3 |
| 190 | M-2 | A/C HEAT RECOVERY | $7,564 | 27.87 | $270 | 0.62 | 28.6 |
| P-684 | A-1 | STORM WINDOWS | $468 | 0.75 | $16 | 0.46 | 29.0 |
| P-360 | E-4 | TIME SW, EXT LT | $539 | 0.44 | $19 | 0.42 | 29.0 |
| P-360 | A-2 | DROP CEILING | $26,918 | 36.21 | $796 | 0.38 | 34.6 |
| P-676 | A-1 | STORM WINDOWS | $3,871 | 5.05 | $111 | 0.37 | 35.6 |
| P-360 | A-1 | STORM WINDOWS | $2,098 | 1.09 | $24 | 0.15 | 89.5 |
| P-673 | E-5 | PHOTO SWITCH, EXT | $211 | 0.06 | $2 | 0.14 | 108.0 |
| | | TOTAL | $43,201 | 74.48 | $1,340 | 0.50 | 40.2 |

TABLE 4 BUILDING ENERGY END-USE ANALYSIS

ANNUAL ENERGY CONSUMPTION (MBTU) (Sheet 1 of 4)

| INSTALLATION | BLDG. NO. | DESCRIPTION | A/C | LIGHTING | D.H.W. | OTHER | TOTAL | S.F. | MBTU/SF | % |
|---|---|---|---|---|---|---|---|---|---|---|
| FT. SHAFTER | P-405 | PRESENT USAGE | 618.13 | 833.00 | 7.60 | 365.20 | 1823.93 | 29,206 | 0.062 | 100% |
| | | SAVINGS BY ECO'S | 49.90 | 3.86 | 0.00 | 0.00 | 53.76 | 29,206 | 0.002 | 3% |
| | | PROJECTED USAGE | 568.23 | 829.14 | 7.60 | 365.20 | 1770.17 | 29,206 | 0.061 | 97% |
| SCHOFIELD BKS. | P-844 | PRESENT USAGE | 965.05 | 1201.50 | 532.08 | 164.10 | 2862.73 | 22,291 | 0.128 | 100% |
| | | SAVINGS BY ECO'S | 382.10 | 38.37 | 0.00 | 0.00 | 420.47 | 22,291 | 0.019 | 15% |
| | | PROJECTED USAGE | 582.95 | 1163.13 | 532.08 | 164.10 | 2442.26 | 22,291 | 0.110 | 85% |
| | P-672 | PRESENT USAGE | 0.00 | 177.20 | 3.17 | 56.70 | 237.07 | 14,100 | 0.017 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 17.01 | 0.00 | 0.00 | 17.01 | 14,100 | 0.001 | 7% |
| | | PROJECTED USAGE | 0.00 | 160.19 | 3.17 | 56.70 | 220.06 | 14,100 | 0.016 | 93% |
| | P-673 | PRESENT USAGE | 453.89 | 217.60 | 4.22 | 376.90 | 1052.61 | 14,136 | 0.074 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 0.59 | 0.00 | 0.00 | 0.59 | 14,136 | 0.000 | 0% |
| | | PROJECTED USAGE | 453.89 | 217.01 | 4.22 | 376.90 | 1052.02 | 14,136 | 0.074 | 100% |
| | P-676 | PRESENT USAGE | 101.42 | 161.00 | 5.28 | 74.80 | 342.50 | 9,840 | 0.035 | 100% |
| | | SAVINGS BY ECO'S | 20.10 | 0.00 | 0.00 | 0.00 | 20.10 | 9,840 | 0.002 | 6% |
| | | PROJECTED USAGE | 81.32 | 161.00 | 5.28 | 74.80 | 322.40 | 9,840 | 0.033 | 94% |
| | P-677 | PRESENT USAGE | 0.00 | 156.00 | 1.06 | 34.50 | 191.56 | 14,400 | 0.013 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 8.20 | 0.00 | 0.00 | 8.20 | 14,400 | 0.001 | 4% |
| | | PROJECTED USAGE | 0.00 | 147.80 | 1.06 | 34.50 | 183.36 | 14,400 | 0.013 | 96% |
| | P-678 | PRESENT USAGE | 276.65 | 164.70 | 212.83 | 395.20 | 1049.38 | 14,400 | 0.073 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 17.64 | 70.70 | 0.00 | 88.34 | 14,400 | 0.006 | 8% |
| | | PROJECTED USAGE | 276.65 | 147.06 | 142.13 | 395.20 | 961.04 | 14,400 | 0.067 | 92% |

TABLE 4 BUILDING ENERGY END-USE ANALYSIS (SHT 2 of 4)

| INSTALLATION | BLDG. NO. | DESCRIPTION | ANNUAL ENERGY CONSUMPTION (MBTU) A/C | LIGHTING | D.H.W. | OTHER | TOTAL | S.F. | MBTU/SF | % |
|---|---|---|---|---|---|---|---|---|---|---|
| SCHOFIELD BKS. (CONTINUED) | P-679 | PRESENT USAGE | 0.00 | 126.00 | 0.00 | 15.70 | 141.70 | 6,531 | 0.022 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6,531 | 0.000 | 0% |
| | | PROJECTED USAGE | 0.00 | 126.00 | 0.00 | 15.70 | 141.70 | 6,531 | 0.022 | 100% |
| | P-680 | PRESENT USAGE | 0.00 | 114.80 | 3.17 | 59.40 | 177.37 | 14,876 | 0.012 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14,876 | 0.000 | 0% |
| | | PROJECTED USAGE | 0.00 | 114.80 | 3.17 | 59.40 | 177.37 | 14,876 | 0.012 | 100% |
| | P-681 | PRESENT USAGE | 0.00 | 225.90 | 1.06 | 9.00 | 235.96 | 11,270 | 0.021 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 11,270 | 0.000 | 0% |
| | | PROJECTED USAGE | 0.00 | 225.90 | 1.06 | 9.00 | 235.96 | 11,270 | 0.021 | 100% |
| | P-682 | PRESENT USAGE | 0.00 | 189.70 | 2.11 | 55.10 | 246.91 | 13,800 | 0.018 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13,800 | 0.000 | 0% |
| | | PROJECTED USAGE | 0.00 | 189.70 | 2.11 | 55.10 | 246.91 | 13,800 | 0.018 | 100% |
| | P-683 | PRESENT USAGE | 27.05 | 132.30 | 0.00 | 9.00 | 168.35 | 6,580 | 0.026 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6,580 | 0.000 | 0% |
| | | PROJECTED USAGE | 27.05 | 132.30 | 0.00 | 9.00 | 168.35 | 6,580 | 0.026 | 100% |
| | P-684 | PRESENT USAGE | 62.27 | 253.30 | 0.00 | 33.00 | 348.57 | 14,490 | 0.024 | 100% |
| | | SAVINGS BY ECO'S | 5.50 | 0.00 | 0.00 | 0.00 | 5.50 | 14,490 | 0.000 | 2% |
| | | PROJECTED USAGE | 56.77 | 253.30 | 0.00 | 33.00 | 343.07 | 14,490 | 0.024 | 98% |
| | P-685 | PRESENT USAGE | 0.00 | 225.90 | 2.11 | 10.80 | 238.81 | 13,500 | 0.018 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13,500 | 0.000 | 0% |
| | | PROJECTED USAGE | 0.00 | 225.90 | 2.11 | 10.80 | 238.81 | 13,500 | 0.018 | 100% |

TABLE 4 BUILDING ENERGY END-USE ANALYSIS (SHT 3 of 4)

| INSTALLATION | BLDG. NO. | DESCRIPTION | ANNUAL ENERGY CONSUMPTION (MBTU) A/C | LIGHTING | D.H.W. | OTHER | TOTAL | S.F. | MBTU/SF | % |
|---|---|---|---|---|---|---|---|---|---|---|
| SCHOFIELD BKS. (CONTINUED) | P-686 | PRESENT USAGE | 19.13 | 162.20 | 2.96 | 7.60 | 191.89 | 14,700 | 0.013 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14,700 | 0.000 | 0% |
| | | PROJECTED USAGE | 19.13 | 162.20 | 2.96 | 7.60 | 191.89 | 14,700 | 0.013 | 100% |
| | P-687 | PRESENT USAGE | 0.00 | 169.70 | 0.00 | 11.50 | 181.20 | 14,700 | 0.012 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 12.88 | 0.00 | 0.00 | 12.88 | 14,700 | 0.001 | 7% |
| | | PROJECTED USAGE | 0.00 | 156.82 | 0.00 | 11.50 | 168.32 | 14,700 | 0.011 | 93% |
| | P-688 | PRESENT USAGE | 0.00 | 444.30 | 0.00 | 34.50 | 478.80 | 14,400 | 0.033 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 20.29 | 0.00 | 0.00 | 20.29 | 14,400 | 0.001 | 4% |
| | | PROJECTED USAGE | 0.00 | 424.01 | 0.00 | 34.50 | 458.51 | 14,400 | 0.032 | 96% |
| | P-691 | PRESENT USAGE | 38.70 | 102.30 | 0.00 | 16.80 | 157.80 | 4,390 | 0.036 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4,390 | 0.000 | 0% |
| | | PROJECTED USAGE | 38.70 | 102.30 | 0.00 | 16.80 | 157.80 | 4,390 | 0.036 | 100% |
| | P-360 | PRESENT USAGE | 168.34 | 299.00 | 0.00 | 123.90 | 591.24 | 12,274 | 0.048 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 14.44 | 0.00 | 0.00 | 14.44 | 12,274 | 0.001 | 2% |
| | | PROJECTED USAGE | 168.34 | 284.56 | 0.00 | 123.90 | 576.80 | 12,274 | 0.047 | 98% |
| | P-584 | PRESENT USAGE | 169.20 | 86.90 | 0.00 | 155.10 | 411.20 | 9,331 | 0.044 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 9,331 | 0.000 | 0% |
| | | PROJECTED USAGE | 169.20 | 86.90 | 0.00 | 155.10 | 411.20 | 9,331 | 0.044 | 100% |
| | P-580 | PRESENT USAGE | 515.54 | 3513.00 | 0.00 | 100.40 | 4128.94 | 88,786 | 0.047 | 100% |
| | | SAVINGS BY ECO'S | 40.10 | 38.70 | 0.00 | 0.00 | 78.80 | 88,786 | 0.001 | 2% |
| | | PROJECTED USAGE | 475.44 | 3474.30 | 0.00 | 100.40 | 4050.14 | 88,786 | 0.046 | 98% |

## TABLE 4 BUILDING ENERGY END-USE ANALYSIS

ANNUAL ENERGY CONSUMPTION (MBTU) (Sheet 4 of 4)

| INSTALLATION | BLDG. NO. | DESCRIPTION | A/C | LIGHTING | D.H.W. | OTHER | TOTAL | S.F. | MBTU/SF | % |
|---|---|---|---|---|---|---|---|---|---|---|
| FT. DeRUSSY | 190 | PRESENT USAGE | 668.99 | 354.90 | 36.06 | 192.70 | 1252.65 | 27,245 | 0.046 | 100% |
| | | SAVINGS BY ECO'S | 69.60 | 114.56 | 0.00 | | 184.16 | 27,245 | 0.007 | 15% |
| | | PROJECTED USAGE | 599.39 | 240.34 | 36.06 | 192.70 | 1068.49 | 27,245 | 0.039 | 85% |
| | 191 | PRESENT USAGE | 98.38 | 110.70 | 0.00 | 15.50 | 224.58 | 17,140 | 0.013 | 100% |
| | | SAVINGS BY ECO'S | 11.20 | 38.03 | 0.00 | 0.00 | 49.23 | 17,140 | 0.003 | 22% |
| | | PROJECTED USAGE | 87.18 | 72.67 | 0.00 | 15.50 | 175.35 | 17,140 | 0.010 | 78% |
| | 192 | PRESENT USAGE | 0.00 | 57.20 | 0.00 | 85.50 | 142.70 | 21,410 | 0.007 | 100% |
| | | SAVINGS BY ECO'S | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 21,410 | 0.000 | 0% |
| | | PROJECTED USAGE | 0.00 | 57.20 | 0.00 | 85.50 | 142.70 | 21,410 | 0.007 | 100% |
| WHEELER AFB | 1003 | PRESENT USAGE | 226.36 | 160.60 | 0.00 | 19.90 | 406.86 | 17,110 | 0.024 | 100% |
| | | SAVINGS BY ECO'S | 23.30 | 0.00 | 0.00 | 0.00 | 23.30 | 17,110 | 0.001 | 6% |
| | | PROJECTED USAGE | 203.06 | 160.60 | 0.00 | 19.90 | 383.56 | 17,110 | 0.022 | 94% |
| TOTAL | | PRESENT USAGE | 4,409.10 | 9,639.70 | 813.71 | 2,422.80 | 17,285.31 | 440,906 | 0.039 | 100% |
| | | SAVINGS BY ECO'S | 601.80 | 324.57 | 70.70 | 0.00 | 997.07 | 440,906 | 0.002 | 6% |
| | | PROJECTED USAGE | 3,807.30 | 9,315.13 | 743.01 | 2,422.80 | 16,288.24 | 440,906 | 0.037 | 94% |

| TOTAL | | ELECTRICITY | | SNG | | LPG | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|
| | | MBTU/YR | $/YR | MBTU/YR | $/YR | MBTU/YR | $/YR | MBTU/YR | $/YR |
| | PRESENT USAGE | 16,479.20 | $362,048 | 770.05 | $7,562 | 36.06 | $349 | 17,285.31 | $369,959 |
| | SAVINGS BY ECO'S | 926.37 | $20,352 | 70.70 | $694 | 0 | $0 | 997.07 | $21,046 |
| | PROJECTED USAGE | 15,552.83 | $341,696 | 699.35 | $6,868 | 36.06 | $349 | 16,288.24 | $348,913 |

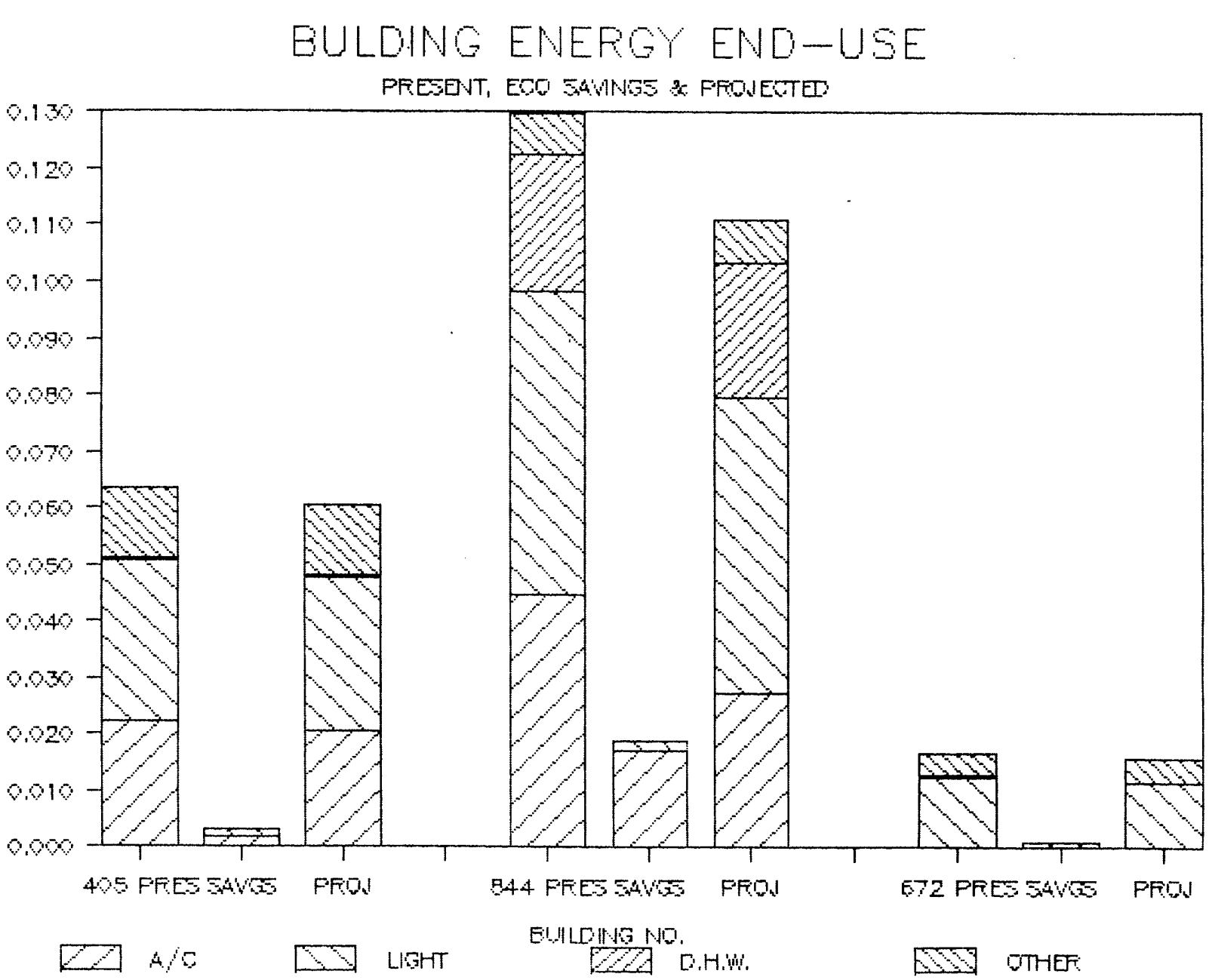



FIGURE 1 (SHEET 1 of 12)

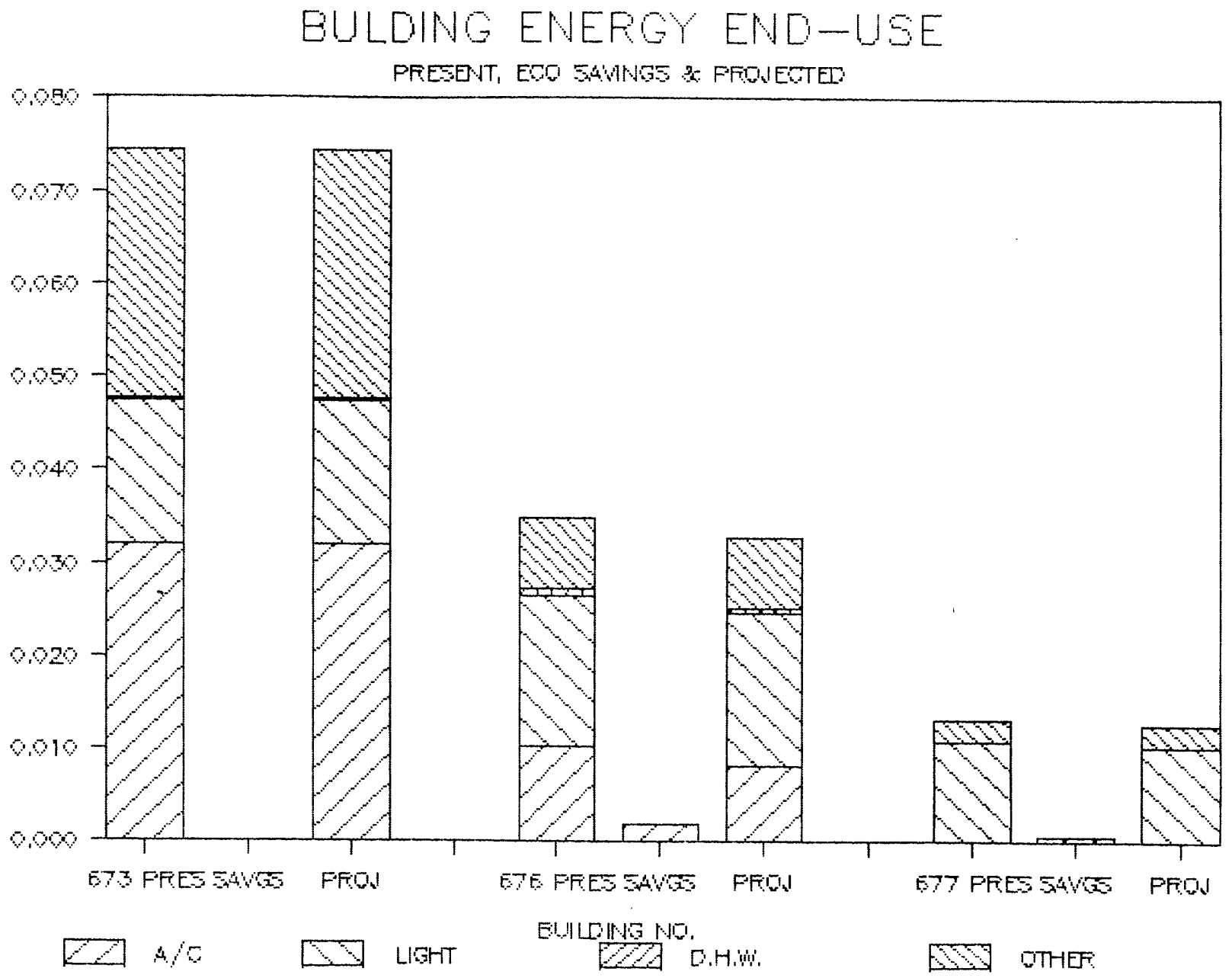



FIGURE 1 (SHEET 2 of 12)

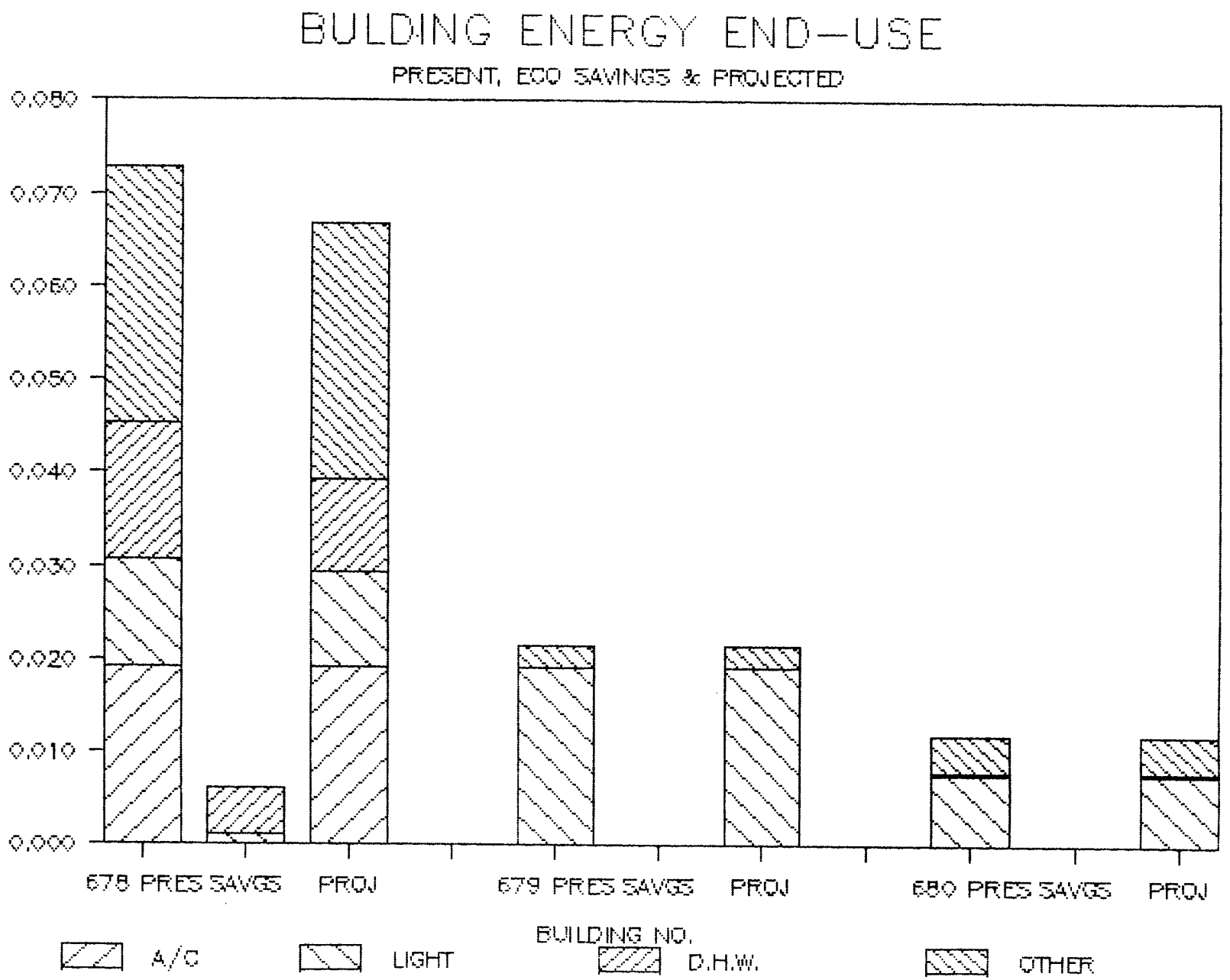



FIGURE 1 (SHEET 3 of 12)

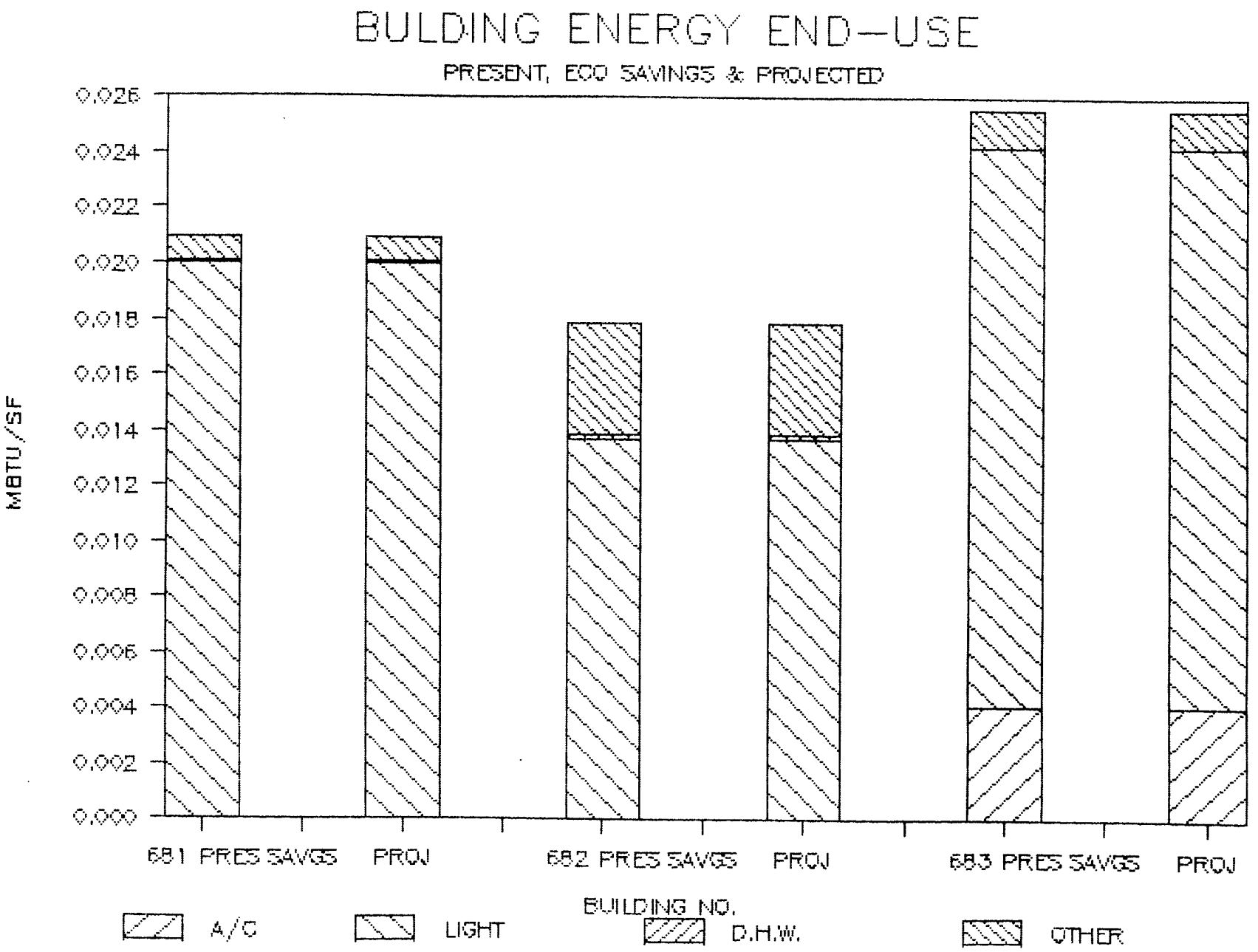



FIGURE 1 (SHEET 4 of 12)

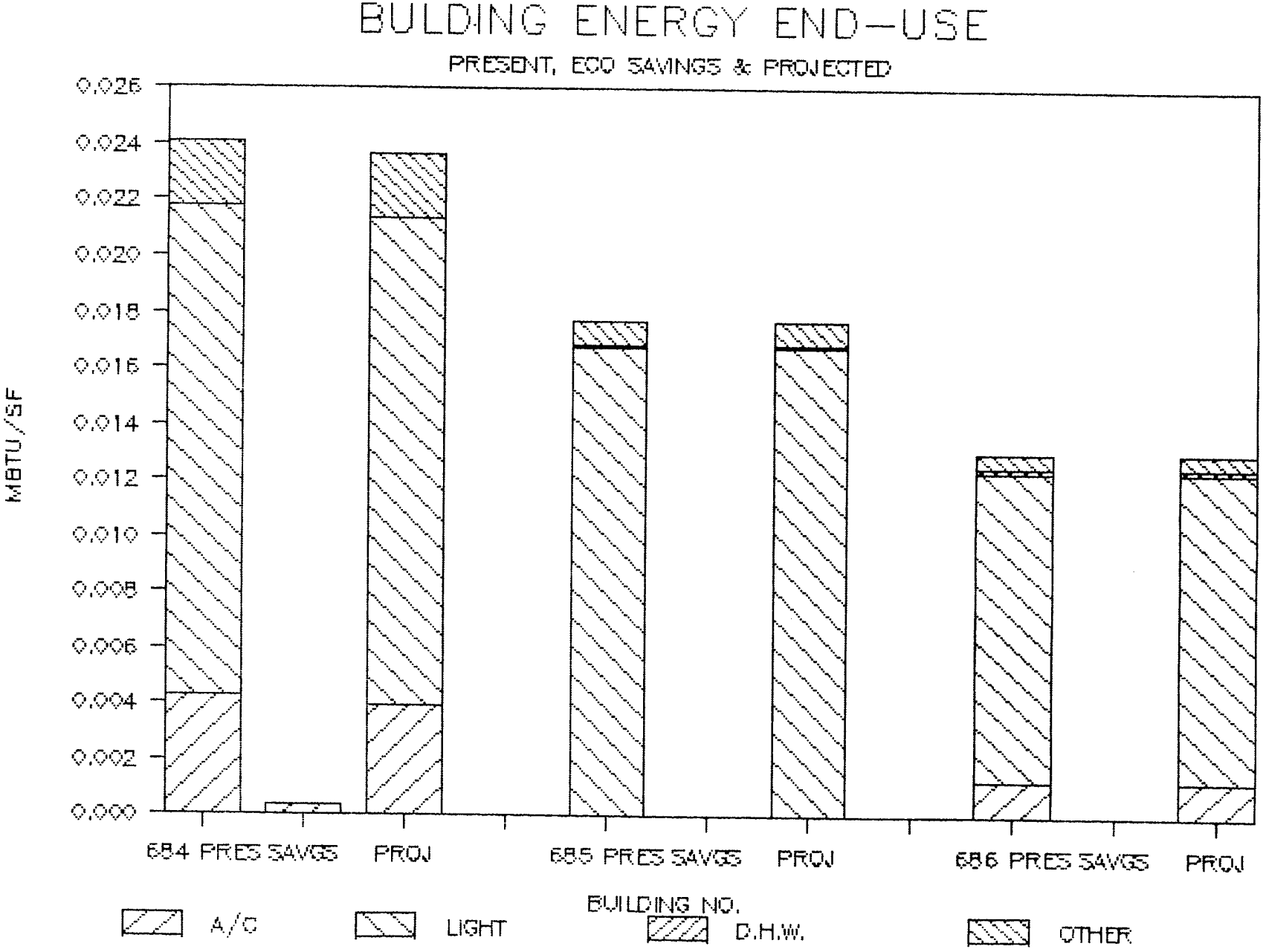



FIGURE 1 (SHEET 5 of 12)

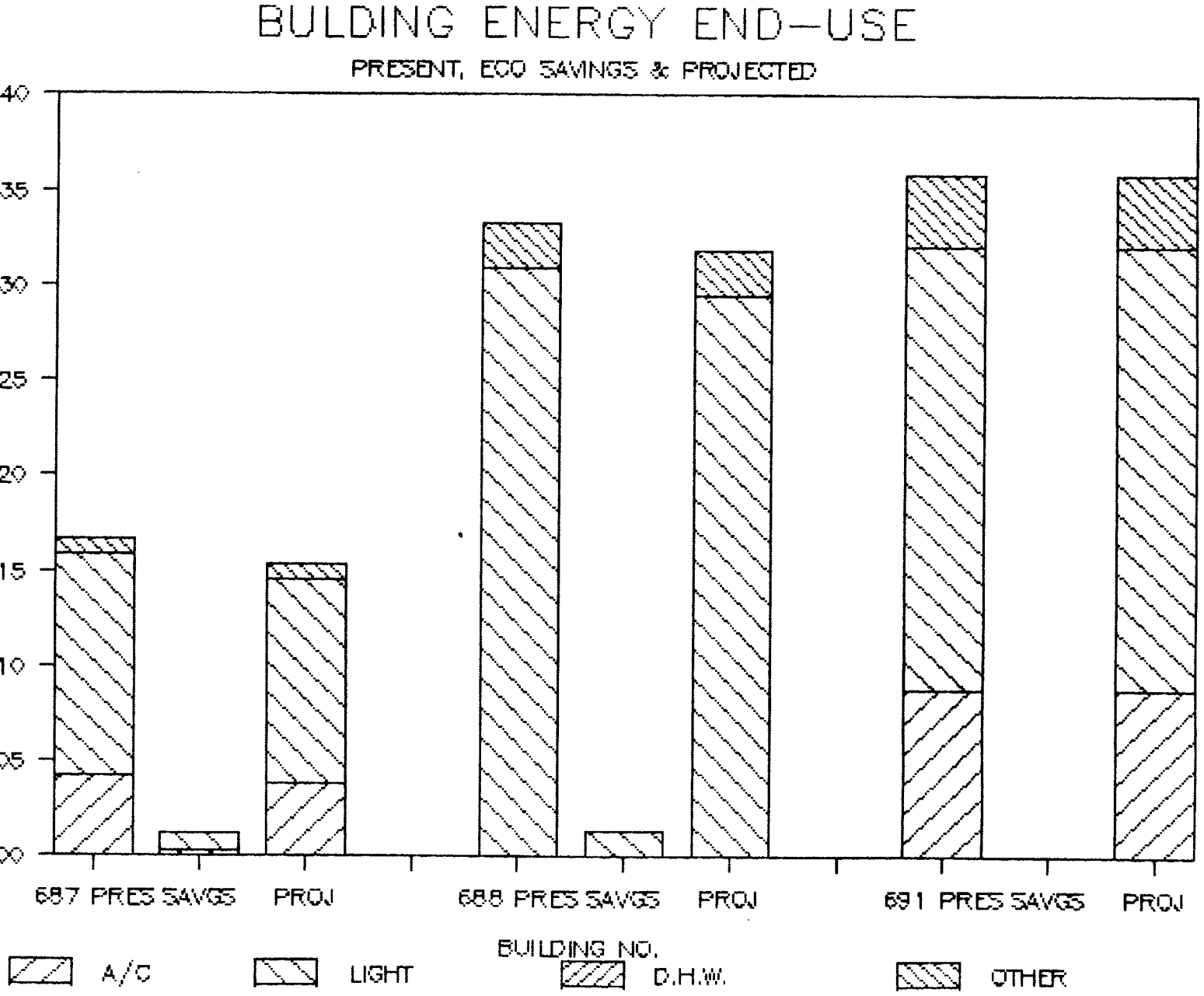



FIGURE 1 (SHEET 6 of 12)

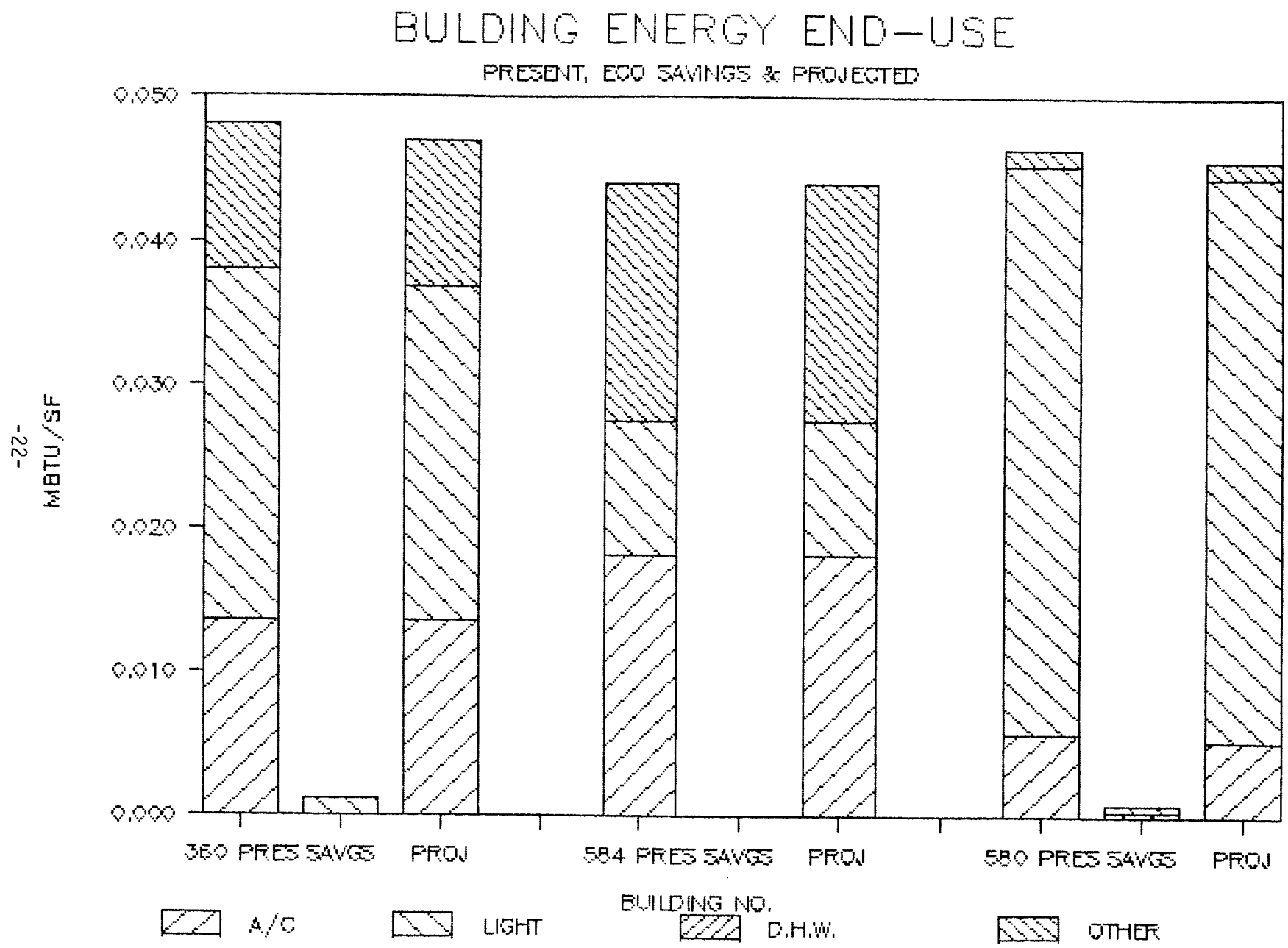



FIGURE 1 (SHEET 7 of 12)

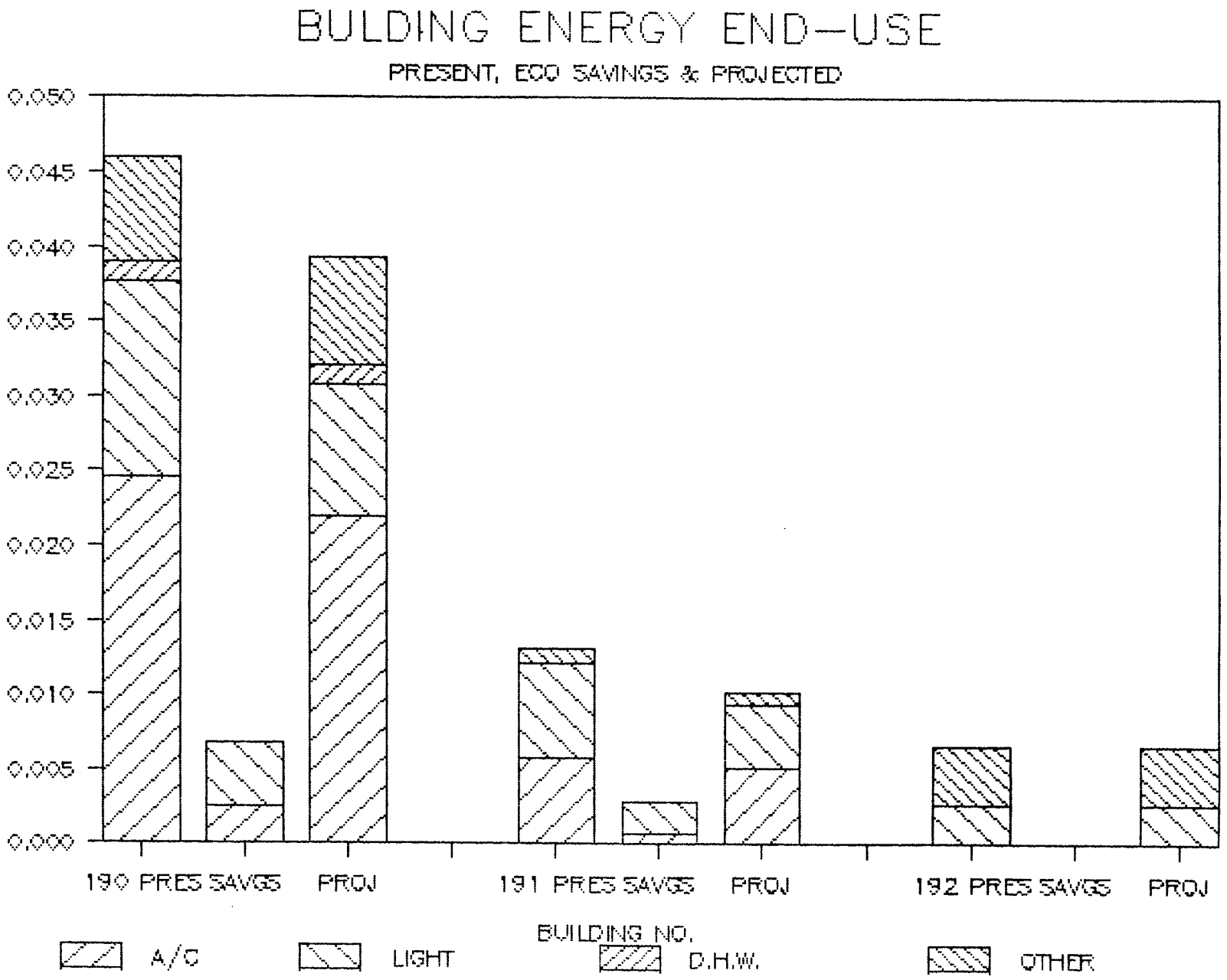



FIGURE 1 (SHEET 8 of 12)

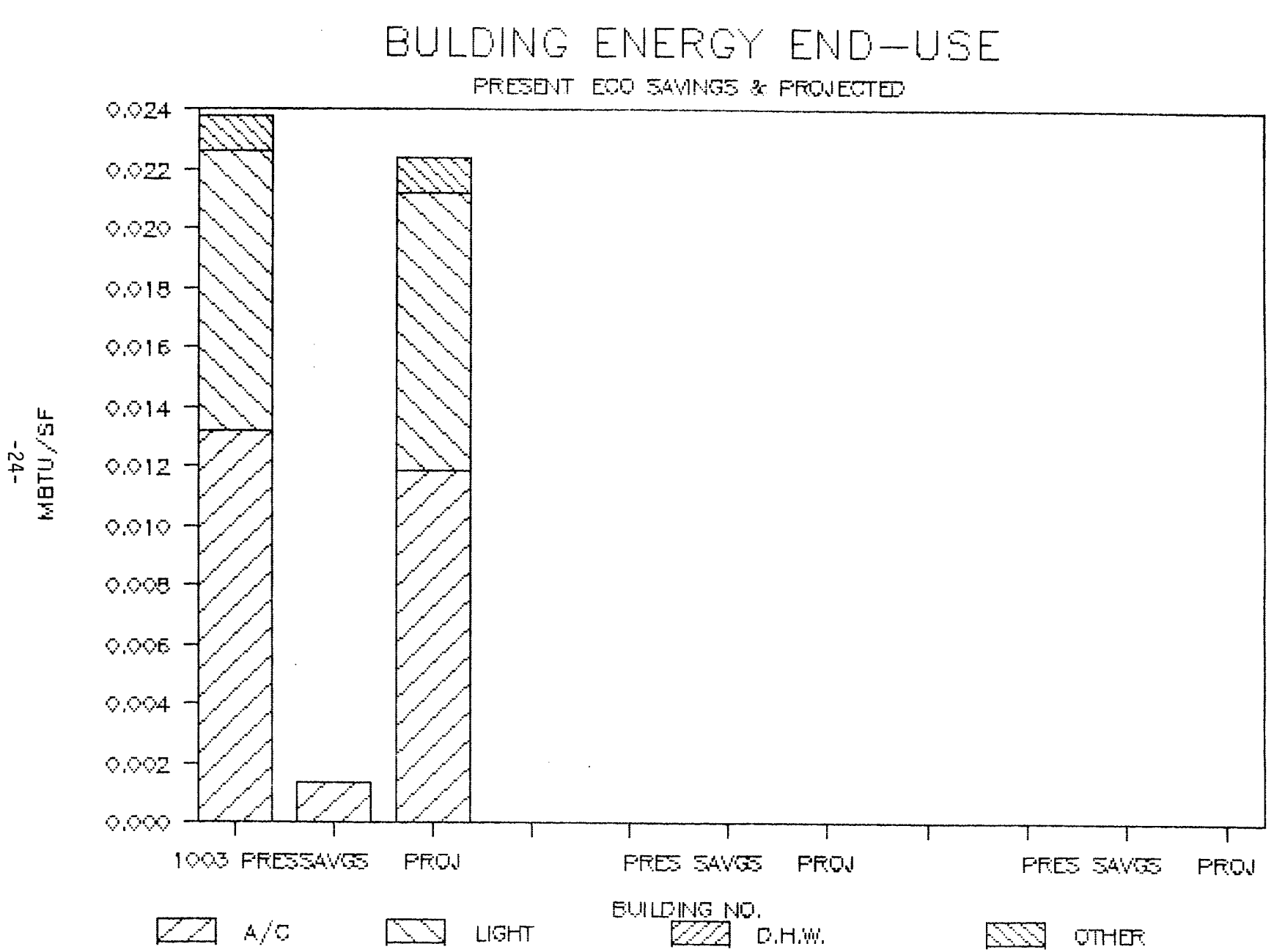


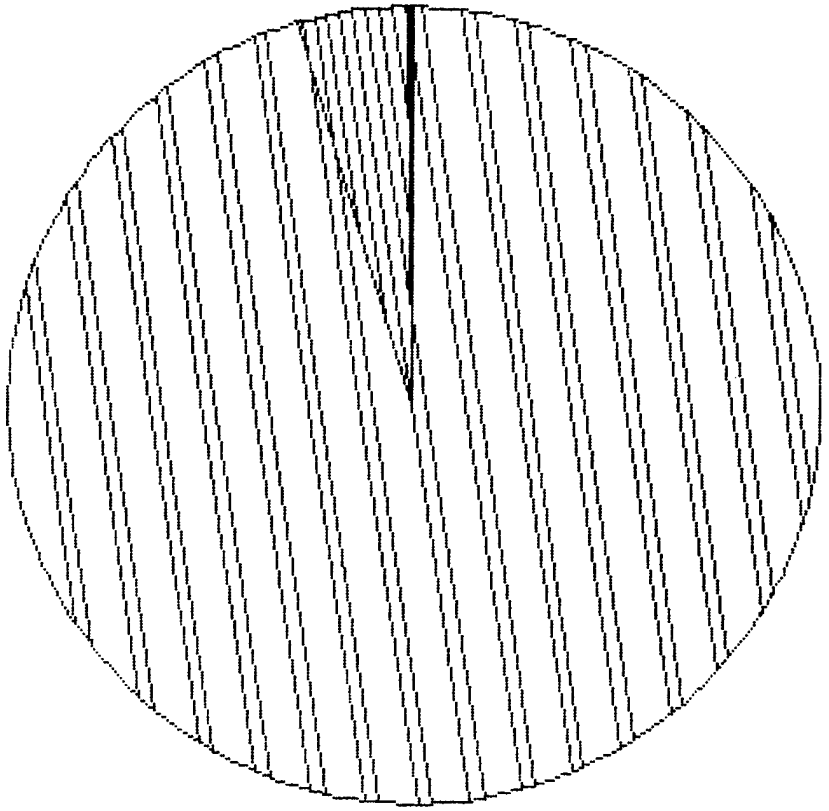

FIGURE 1 (SHEET 9 of 12)

# BUILDING ENERGY END-USE

## PRESENT ENERGY CONSUMPTION

SNG (4.5%)
770.05 MBTU/YR
$7,562/YR

LPG (0.2%)
36.06 MBTU/YR
$349/YR



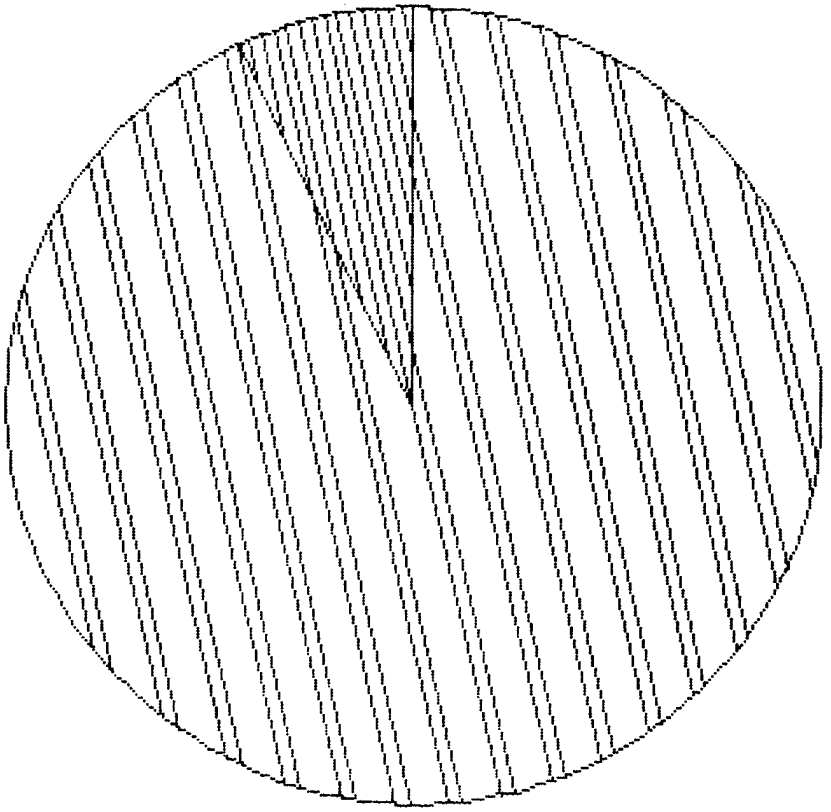
(ELECTRICITY (95.3%)
16,479.20 MBTU/YR
$362,048/YR

FIGURE 1 (SHEET 10 of 12)

# BUILDING ENERGY END-USE

## ECO'S ENERGY SAVINGS

| SNG (7.1%) | LPG (0.0%) |
|---|---|
| 70.70 MBTU/YR | 0 MBTU/YR |
| $694/YR | $0/YR |



ELECTRICITY (92.9%)

926.37 MBTU/YR
$20,352/YR

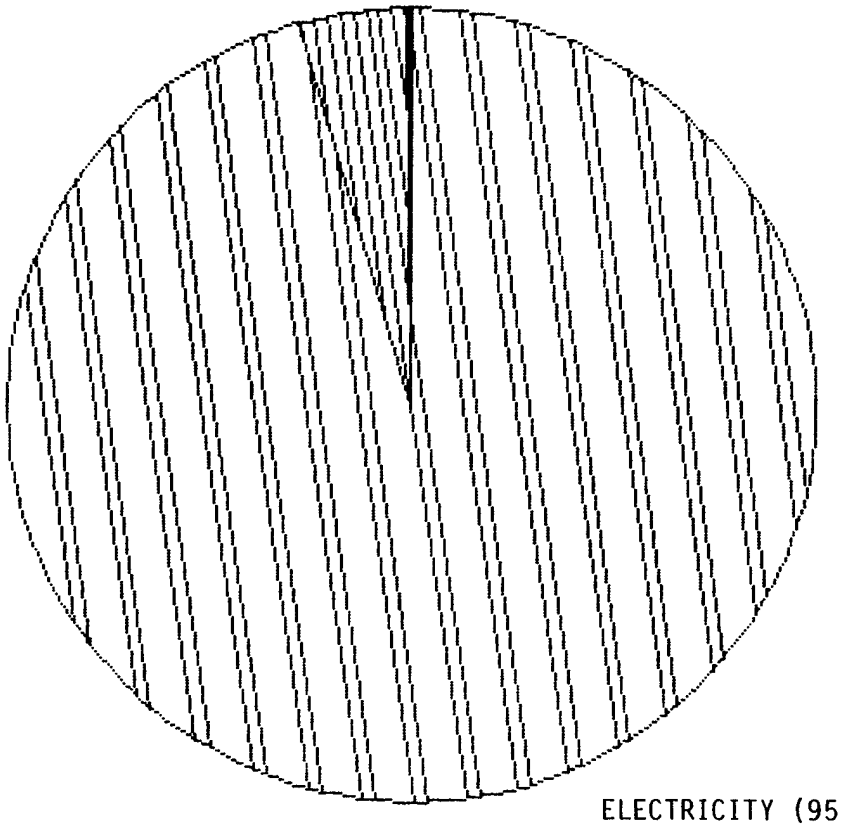
FIGURE 1 (SHEET 11 of 12)

# BUILDING ENERGY END-USE

## PROJECTED ENERGY CONSUMPTION

SNG (4.3%)
699.35 MBTU/YR
$6,868/YR

LPG (0.2%)
36.06 MBTU/YR
$349/YR



ELECTRICITY (95.5%)
15,552.83 MBTU/YR
$341,696/YR

FIGURE 1 (SHEET 12 of 12)